

# **EXHIBIT 7**

# MEASURING THE IMPLICATIONS OF SALES AND CONSUMER INVENTORY BEHAVIOR

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Temporary price reductions (sales) are common for many goods and naturally result in large increases in the quantity sold. Demand estimation based on temporary price reductions may mismeasure the long-run responsiveness to prices. In this paper we quantify the extent of the problem and assess its economic implications. We structurally estimate a dynamic model of consumer choice using two years of scanner data on the purchasing behavior of a panel of households. The results suggest that static demand estimates, which neglect dynamics, (i) overestimate own-price elasticities by 30 percent, (ii) underestimate cross-price elasticities by up to a factor of 5, and (iii) overestimate the substitution to the no-purchase or outside option by over 200 percent. This suggests that policy analysis based on static elasticity estimates will underestimate price–cost margins and underpredict the effects of mergers.

**KEYWORDS:** Long-run price elasticities, stockpiling, demand anticipation, discrete choice models, differentiated products, storable goods.

## 1. INTRODUCTION

WHEN GOODS ARE STORABLE, traditional static demand analysis is likely to mismeasure long-run own- and cross- price elasticities. A temporary price decrease may generate a large demand increase. However, if part of the increase is due to intertemporal substitution, then the (long-run) own-price response to a permanent price reduction would be smaller than static estimates suggest. On the other hand, the direction of the bias on cross-price elasticities is ambiguous. Static demand models are misspecified because they do not control for relevant history like past prices and inventories, and therefore estimates of price sensitivity might be biased. Even adding the right controls, static estimation confounds long- and short-run price effects. Measuring the long term response is relevant for most applications. For example, demand estimates are central in antitrust analysis and for computing welfare gains from new goods.

The distinction between long-run and short-run responses dates back to the Lucas and Rapping (1969) labor market study. Labor supply in their model responds to short-run wage changes differently than to long-run changes. In the context of product market demand estimation, most applications have neglected intertemporal effects (Bresnahan (1987), Hausman, Leonard, and Zona (1994), and Berry, Levinsohn, and Pakes (1995), as well as many others). Dynamic effects could be important, for example, for either durable or storable products. Previous work in the marketing and economics literature, which

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